



## Characterization factors for global warming in life cycle assessment based on damages to humans and ecosystems

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### Abstract:

Human and ecosystem health damage due to greenhouse gas (GHG) emissions is generally poorly quantified in the life cycle assessment of products, preventing an integrated comparison of the importance of GHGs with other stressor types, such as ozone depletion and acidifying emissions. In this study, we derived new characterization factors for 63 GHGs that quantify the impact of an emission change on human and ecosystem health damage. For human health damage, the Disability Adjusted Life Years (DALYs) per unit emission related to malaria, diarrhea, malnutrition, drowning, and cardiovascular diseases were quantified. For ecosystem health damage, the Potentially Disappeared Fraction (PDF) over space and time of various species groups, including plants, butterflies, birds, and mammals, per unit emission was calculated. The influence of value choices in the modeling procedure was analyzed by defining three coherent scenarios, based on Cultural theory perspectives. It was found that the characterization factor for human health damage by carbon dioxide (CO<sub>2</sub>) ranges from  $1.1 \times 10^{-2}$  to  $1.8 \times 10^{+1}$  DALY per kton of emission, while the characterization factor for ecosystem damage by CO<sub>2</sub> ranges from  $5.4 \times 10^{-2}$  to  $1.2 \times 10^{+1}$  disappeared fraction of species over space and time ((km<sup>2</sup>-year)/kton), depending on the scenario chosen. The characterization factor of a GHG can change up to 4 orders of magnitude, depending on the scenario. The scenario-specific differences are mainly explained by the choice for a specific time horizon and stresses the importance of dealing with value choices in the life cycle impact assessment of GHG emissions.

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### Resource Description

#### Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Ecosystem Changes, Temperature

**Temperature:** Fluctuations

#### Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

#### Geographic Location:

# Climate Change and Human Health Literature Portal



resource focuses on specific location

Global or Unspecified

## Health Impact:

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

## Resource Type:

format or standard characteristic of resource

Research Article, Review

## Timescale:

time period studied

Time Scale Unspecified